

REMARKS

As an initial matter, Applicants' Representative thanks Examiner Langel for participating in an interview of this application on October 6, 2008. The sole remaining rejection under 35 U.S.C. 103(a) was discussed, as well as the cited references for that rejection. Applicants pointed to the express teaching of the reference that the partial oxidation zone and the reforming zone be separate and distinct. No agreement was reached.

This communication is responsive to a final office action and is intended to place the application in condition for allowance, or to at least reduce the issues on appeal. Entry of this communication to the record is respectfully requested.

No claims are presently amended, canceled, or added by this communication. As such, no new matter has been added. Claims 1, 2, 4-17, and 19-21 remain pending in this application.

Applicants respectfully request reconsideration of the present application in view of the reasons that follow.

The sole remaining rejection is of claims 1, 2, 4-17 and 19-21 under 35 U.S.C. § 103(a), as being unpatentable over Clawson *et al.*¹ in view of Hwang *et al.*² Applicants respectfully traverse these rejections.

Claim 1 is directed to a fuel processor for generating a H₂ rich gas from a fuel. Claim 1 recites in full:

A fuel processor for generating a H₂ rich gas from a fuel, comprising:
(a) an inlet projecting through an exterior housing of the fuel processor attached to a steam line, an O₂ rich gas line, and a fuel line;
(b) an inner reforming zone comprising a sidewall, a first end connected to the inlet, a partial oxidation catalyst and a steam reforming

¹ U.S. 6,083,425.

² U.S. 6,436,363.

catalyst or a combined partial oxidation and steam reforming catalyst, and a second end;

(c) an outer reforming zone comprising the sidewall of the inner reforming zone, an outer sidewall, a first end connected to the second end of the inner reforming zone, and a second end;

(d) a cooling zone comprising a first end connected to the second end of the outer reforming zone and a second end;

(e) a sulfur removal zone comprising a sulfur removal agent, a first end connected to the second end of the cooling zone, and a second end; and

(f) a water-gas-shift zone comprising a catalyst that catalyzes the conversion of carbon monoxide and water to carbon dioxide and H₂, a first end connected to the second end of the sulfur removal zone, and a second end connected to an outlet of the fuel processor;

wherein the outer reforming zone further comprises a partial oxidation catalyst and a steam reforming catalyst or a combined partial oxidation and steam reforming catalyst.

In summary, the presently claimed invention is directed, in part, to "a fuel processor for generating a H₂ rich gas from a fuel...wherein the outer zone [of the processor has] a partial oxidation catalyst and a steam reforming catalyst..." As stated in the specification.³

The invented process and fuel processor designs overcome the high temperature problem of partial oxidation reactors, yet have excellent transient response capability, a significant problem associated with steam reforming. The fuel processor does this by providing at least one chamber in which partial oxidation and steam reforming are conducted simultaneously and by being designed such that heat generated from partial oxidation is used in the steam reforming reaction.

In describing one embodiment, by way of reference to the figures, the specification describes FIG. 4 stating:⁴

Inner reforming zone 30 contains a partial oxidation catalyst and a steam reforming catalyst or a catalyst that is useful in catalyzing both partial oxidation and steam reforming. Preferred such catalysts are those described above. Outer reforming zone 40 optionally, but preferably contains the same catalyst or catalysts used in inner reforming zone 30.

³ See specification as published as US 2004/016133, paragraph 48.

⁴ See *Id.* at paragraph 83.

Thus, both partial oxidation and steam reforming are accomplished in inner reforming zone when the mixture of fuel oxygen, and steam contacts the catalysts. Sulfur removal zone 60 contains a material which is known to remove sulfur compounds, preferably H₂S or COS, from the reformatre gas stream. An example of a particularly useful sulfur removal agent is zinc oxide, which is converted to zinc sulfide upon reaction with H₂S effectively removing sulfur from the gas stream. Water-gas-shift zone 70 contains a catalyst such as those described above for catalyzing the reaction of carbon monoxide and water to carbon dioxide and H₂.

In accordance with the description, the presently claimed invention allows for fuel, air, and steam to be simultaneously fed to a catalytic reaction zone where the mixture undergoes reforming reactions. There are at least three catalytic reaction zones: the inner reforming zone, the outer reforming zone, and the water gas shift reaction zone. According to claim 1, the outer reforming zone contains a partial oxidation catalyst and a steam reforming catalyst so that both reactions are accomplished within the same chamber of the fuel processor. According to claim 11, the inner reforming zone contains a partial oxidation catalyst and a steam reforming catalyst.

As pointed out in the background, fuel cells were known where these chambers were separated,⁵ however there are problems with separation of the zone such as the high temperatures (>1000°C) associated with partial oxidation catalysts.⁶

Clawson is one of the fuel processors that explicitly describes separate partial oxidation and reforming zones. In fact, Clawson states that “[t]hat the reformer includes a first vessel having a partial oxidation reaction zone and a *separate* steam reforming reaction zone that is *distinct* from the partial oxidation reaction zone.”⁷ As such, Clawson explicitly teaches away from partial oxidation and steam reforming catalysts in the same zone. As the Supreme Court commented in *KSR Int'l Co. v. Teleflex Inc.*, “[w]hen the prior art teaches away from combining

⁵ See *Id.* at paragraphs 7-12.

⁶ See *Id.* at paragraph 47.

⁷ See U.S. 6,083,425 at col. 1, lines 63-66.

certain known elements, discovery of successful means of combining them is more likely to be non-obvious.”⁸

In the final Office Action, the Examiner asserts that this teaching away from the combination was Applicants’ “argument,” and that it was not convincing. In the interview, the Examiner stated that the pending claims were more directed to methods than the device itself. However, Applicants vigorously disagree that this characterization. Clawson explicitly states that the zones are separate and distinct. This is not argument, these are Clawson’s own words:⁹

...the reformer includes a first vessel having a partial oxidation reaction zone and a *separate* steam reforming reaction zone that is *distinct* from the partial oxidation reaction zone.

No argument to this fact of separation is needed, Clawson states the fact.

The Examiner then alleges that it would be obvious to employ a mixture of platinum and palladium as both a steam reforming catalyst and the partial oxidation catalyst.¹⁰ Again, Applicants respectfully disagree. The claims clearly state that a given catalytic zone contains both a partial oxidation catalyst and a reforming catalyst. Thus, this is not directed to the method of catalysis, but rather is the catalytic apparatus itself.

Clawson teaches a number of catalysts for the steam reforming zone¹¹ and a number of catalysts for the partial oxidation zones.¹² Yet, Clawson is explicit that the zones in which these operate are separate and distinct, as shown above. The Examiner appears to allege that because platinum and palladium appear in both lists that one can act as the other within a given zone. For example, the Examiner appears to allege that where platinum is present in a steam reforming zone it can act as a partial oxidation catalyst and *vice versa*.

⁸ 127 S.Ct. 1727, 1740, 82 USPQ2d 1385, 1395 (2007), *citing United States v. Adams* 383 U.S. 39, 40, 148 USPQ 479 (1966).

⁹ U.S. 6,083,425 at col. 1, lines 63-66, emphasis added.

¹⁰ Final Office Action mailed August 11, 2008, page 2, lines 12-17.

¹¹ See U.S. 6,083,425 at col. 3, line 61- col. 4, line 10.

¹² See *Id.* at col. 5, lines 26-33.

In contrast, Applicants submit that more than just the identity of the catalyst is at work in these systems. There are considerations given to temperatures in the zones, flow rates, etc. In fact, Clawson describes both high temperature and low temperature shift zones and the catalysts that are used in each or not wholly the same.¹³ Further, Clawson's list of steam reforming catalysts is not the wholly the same as the shift zone catalysts.¹⁴ With regard to temperatures, Clawson states that the steam reforming zone has a temperature of 700 to 900°C¹⁵ and the partial oxidation zone has a temperature from about 950 to 1150°C.¹⁶ Thus, these two zones operate at different temperatures thereby resulting in different effects according to Clawson. Applicants submit that, based upon Clawson, there is no reason given to one of skill in the art to use the catalysts of one zone in another. Further, there is no reason provided by Clawson that if the skilled artisan were to use a platinum or palladium catalyst in a partial oxidation zone at a high temperature, that it would, or even could, function as a steam reforming catalyst at that temperature, as is suggested by the Examiner.

The Examiner is reminded that the “[t]he mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency...That which may be inherent is not necessarily known. Obviousness cannot be predicated on what is unknown....”¹⁷ Here the explicit teaching away from the combination of a steam reforming catalyst and a partial oxidation catalyst in the same zone, and the different temperatures in those zones, do not provide reasons to one of skill in the art to make the Examiner's proposed modification of Clawson. In view of Clawson, Applicants submit that to the skilled artisan, the combination of a partial oxidation catalyst and a steam reforming catalyst in the same zone remains unknown and cannot form the basis for a *prima facie* case of obviousness.

Applicants have shown above that Clawson fails to teach or suggest the combination of a partial oxidation catalyst and a steam reforming catalyst in the same zone, and, in fact, Clawson

¹³ See *Id.* at col. 4, line 43 – col. 5, line 40.

¹⁴ See *Id.* at col. 3, lines 63-67 and col. 4, line 43 – col. 5, line 40.

¹⁵ See *Id.* at col. 6, line 14.

¹⁶ See *Id.* at col. 6, line 3.

explicitly teaches away from such a combination. As such, Hwang must then be relied upon for such a teaching. However, if the proposed combination were so made, then Hwang would render Clawson unsuitable for its intended purpose, contrary to the teaching of MPEP 2143.01 (V) (“The proposed modification cannot render the prior art unsatisfactory for its intended purpose”).

Hwang is directed to a monolithic substrate with a channel that allows for a hydrocarbon, water, air mixture stream to flow.¹⁸ Hwang discloses layered partial oxidation and steam reforming catalysts on the substrate, where one layer is on top of another layer, or they may be zoned.¹⁹ However, there is no suggestion that they may be combined, and even if they were combined, there is no suggestion to use such materials in the fuel processor of Clawson.

In the present Final Office Action, the Examiner references the previous Non-final Office Action, for the rejection based upon Hwang.²⁰ In the Non-final Office Action, the Examiner stated that “it would have been obvious from such a disclosure of Hwang et al to employ a catalyst comprising platinum on gadolinium doped ceria as the catalyst in the inner zone of Clawson.²¹

However, the explicit requirement in Clawson of the separate and distinct reforming zone and partial oxidation zone defeats any suggestion of using one with the other, contrary to the Examiner’s suggestion. Clawson has provided separate and distinct regions and the Examiner’s suggestion to subvert this requirement by combining with Hwang, could render Clawson unsatisfactory for its intended purposes contrary to the MPEP 2143.01 (V) (The proposed modification cannot render the prior art unsatisfactory for its intended purpose).

Applicant submits that by Clawson requiring separate and distinct partial oxidation and steam reforming zones, combination to combine the two zones based upon Clawson must fail.

¹⁷ *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993), citations omitted.

¹⁸ See U.S. 6,436,363 at col. 7, lines 5-19.

¹⁹ See *Id.* at col. 3, lines 48-60.

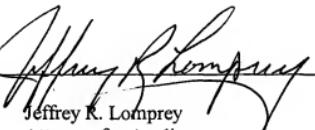
²⁰ Final Office Action mailed August 11, 2008, page 2, lines 9-10.

²¹ Non-final Office Action mailed April 9, 2008, page 4.

Applicant respectfully requests that the present rejections based upon Clawson and Hwang be withdrawn and the application allowed to proceed to issuance.

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested. The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

Respectfully submitted,

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